

# Berkeley County Continuing Education

## SCDOT Traffic Management

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Josh Johnson is the District Six Traffic Engineer for SCDOT, overseeing traffic operations and design for Berkeley, Charleston, Dorchester, Colleton, Beaufort, and Jasper Counties. He holds Bachelor's and Master's degrees in civil engineering from Clemson University, is a registered Professional Engineer (PE) and Professional Traffic Operations Engineer (PTOE) and has ten years of experience in the private and public sectors. Josh is a resident of Goose Creek with his wife, Jenna, and two children, and is the Chairman of the City of Goose Creek Planning Commission

# Discussion Items

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- Encroachment permitting process
- Traffic Impact Study requirements
- Traffic mitigation
- Agency coordination

# Encroachment Permitting



SCDOT

## Encroachment Permits

Encroachment Permits

### SCDOT Encroachment Permit Processing System (EPPS)


Welcome to the South Carolina Department of Transportation's online system for management of the Encroachment Permit application process and for managing and tracking Encroachment Permits as they are processed by SCDOT and the customer.

Important Announcements

811 Know what's below. Call before you dig.

- Online applications (EPPS)
- District permit office vs. county permit office

# Application Checklist



South Carolina Department of Transportation

The following checklist is provided as a tool to verify that all necessary documentation is included in your submittal. Once complete, upload this certification into the Encroachment Permit Processing System (EPPS) as a required document to submit your Application.

**Signed Permit Application** – The Applicant is required to input their information, print, sign, and upload the document as a pdf into EPPS. **Agent Authorization Letter (Section 2A, ARMS)**

- Signed application
- Construction plans
  - Dimensions of design elements
  - Pavements markings
  - Signing
  - Pavement design
  - Drainage
  - Sight distance
- Drainage analysis
- Approved traffic study
- Local government approval
- DHEC approval

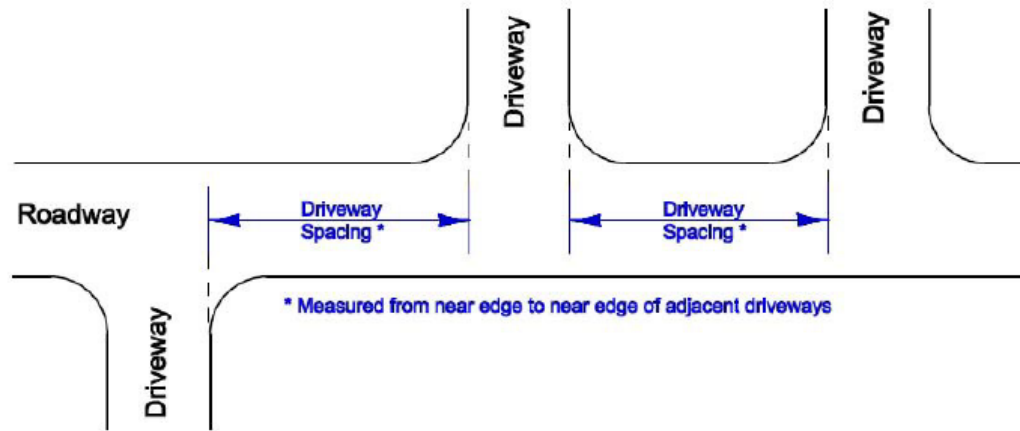
# ARMS Manual



- On SCDOT website
- Information provided
  - Driveway spacing
  - Driveway radii
  - Driveway profile
  - Throat distance
  - Turn lane design
  - Signal spacing
  - Traffic impact studies
  - Sight distance
  - Etc., etc., etc.

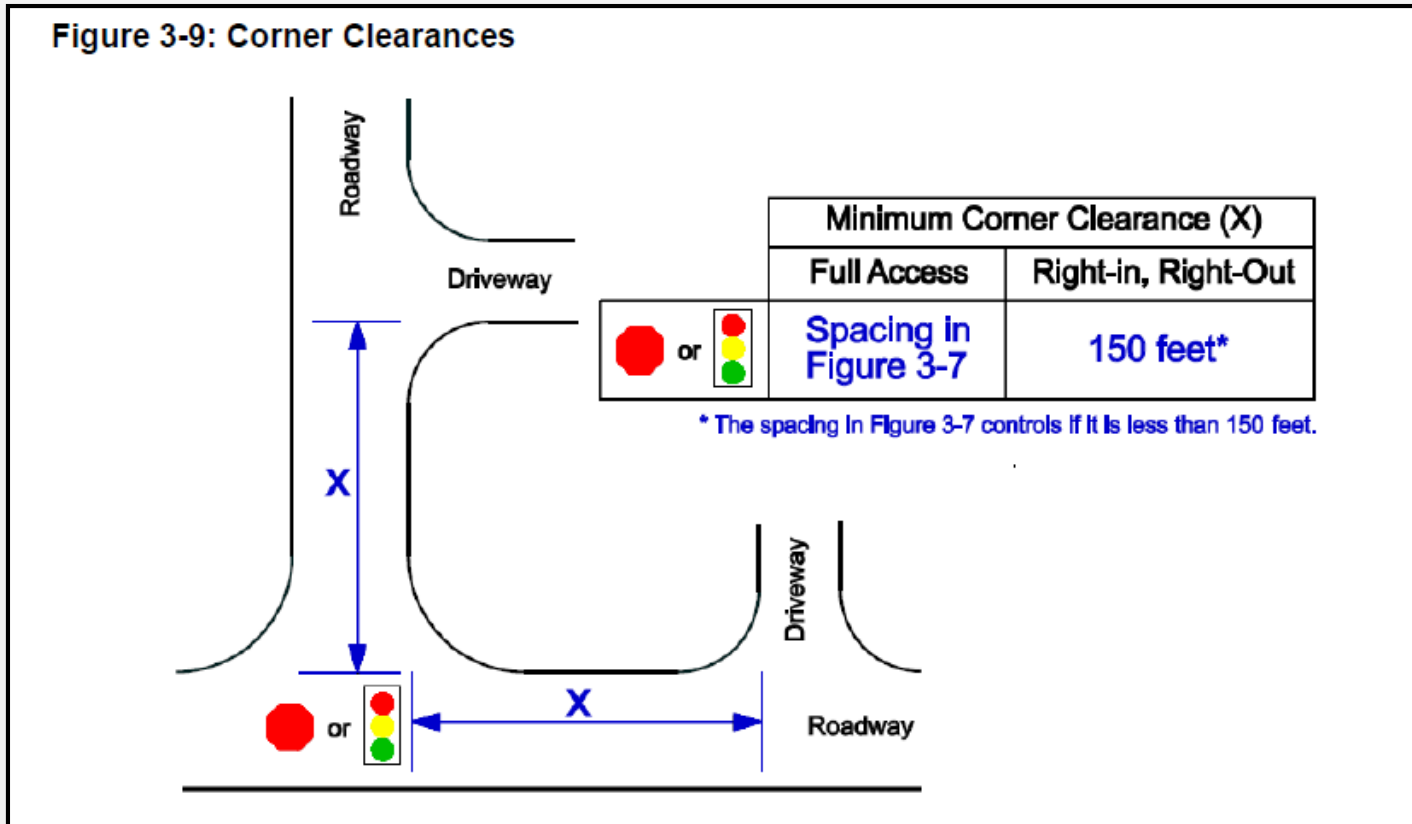
# Driveway Spacing - Full

Figure 3-7: Minimum Driveway Spacing



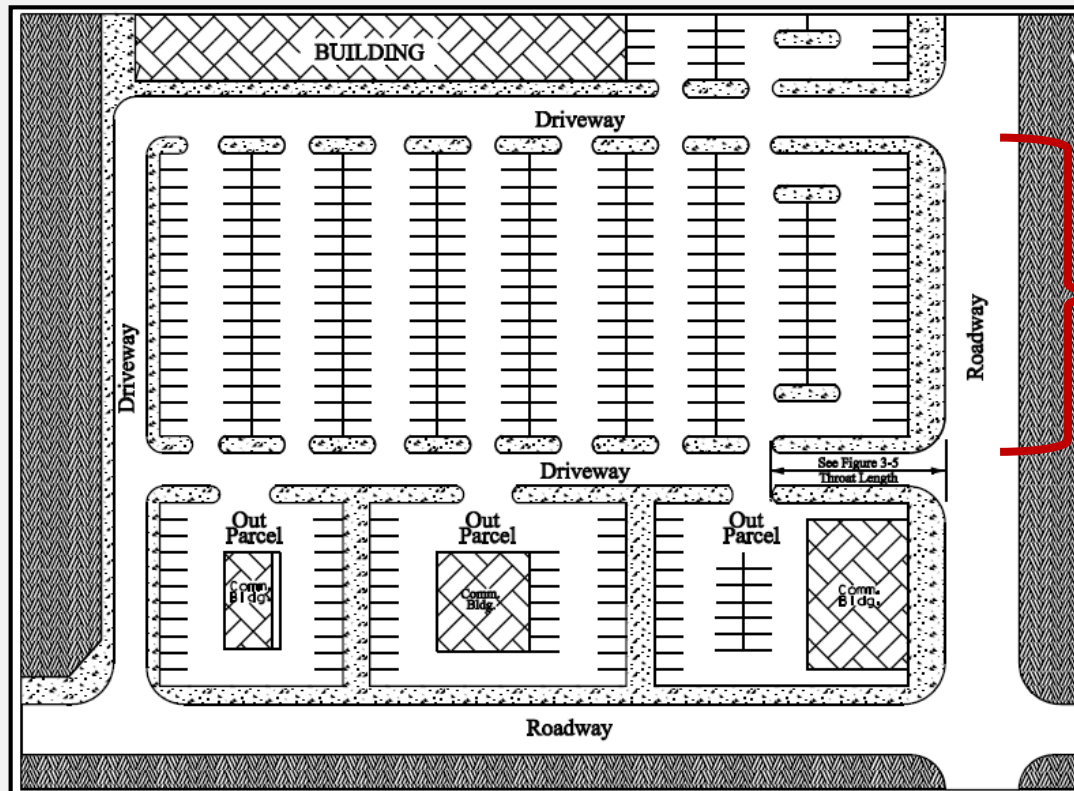
Posted Speed Limit (mph)	Minimum Driveway Spacing (ft) on roadways with AADT $\geq 2000$ or Driveways Generating more than 50 Peak Hour Trips	Minimum Driveway Spacing (ft) on roadways with AADT $< 2000$
30	160	75
35	220	125
40	275	175
45	325	225
$\geq 50$	400	275

# Driveway Spacing - RIRO



# Driveway Spacing – Large Parcels

In the case of large developments with outparcels, access for outparcels should be provided only internally; however, shared or individual driveways may be permitted provided that **twice the normal spacing** requirements are met.



Twice  
normal  
spacing



# Evaluating Access

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- Must provide access to state system
- May be right-in / right-out only
- Driveway spacing / alignment
- Avoid access within turn lanes
- Mitigation needs (turn lanes)
- Sight distance
- Master corridor planning

# Driveway Radius & Width

**Table 3-3: Driveway Classification**

<b>Driveway Classification</b>	<b>Expected Trips</b>	<b>Example Land Use</b>	<b>Design Features</b>
Low Volume	1-20 trips/day 1-5 trips/hour	Residential Drives (1-2 single family homes)	Typically designed with minimum requirements.
Medium Volume	21-600 trips/day 6-60 trips/hour	Small subdivisions with single family homes or apartments, small business or specialty shop	Typically designed with some higher volume features such as radial returns.
High Volume	601-4,000 trips/day 61-400 trips/hour	Convenience store, gas stations, or small shopping center	Typically designed with high volume features such as radial returns and turn lanes.
Major Volume	>4,000 trips/day >400 trips/hour	Large shopping center or regional mall	Designed with high volume features including radial returns, turn lanes, and medians.

# Driveway Radius & Width

**Table 3-4: Driveway Widths and Radii**

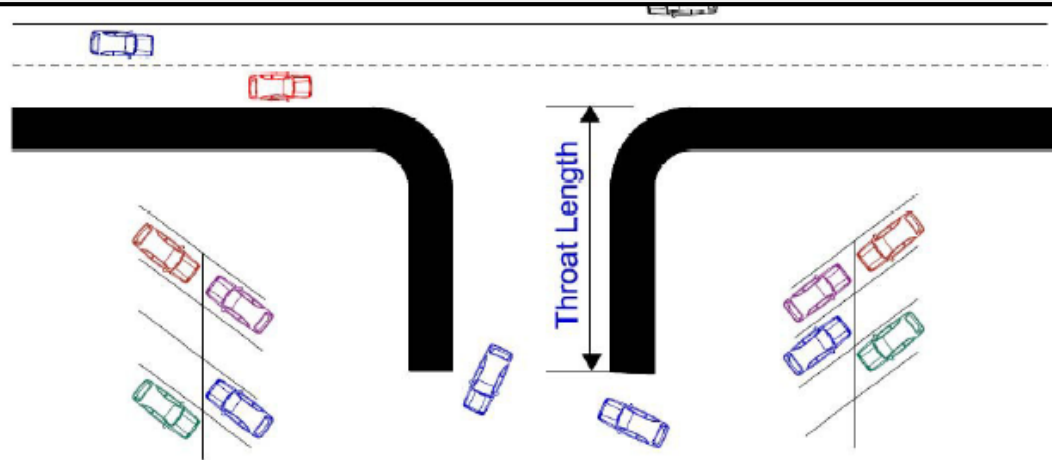
<b>Driveway Class</b>	<b>Driveway Width (feet)</b>	<b>Minimum Radius Returns (feet)</b>
Low Volume	10 – 24	15
Medium Volume	24 – 40*	30 (40 Recommended)
High Volume	40**	**
Major Volume	**	**

\* A 40 ft. driveway is usually marked with two exit lanes of 12 ft. width, with the balance of 16 ft. used for a single, wide entry lane. When a median divider is used, the throat width should be increased to maintain the same lane widths.

\*\*Driveway widths, radii, and lane requirements are determined by a traffic study.

\*\*\* For one-way drives, use 14 to 24 feet depending on vehicle usage, width should not encourage two-way movement.

# Driveway Throat



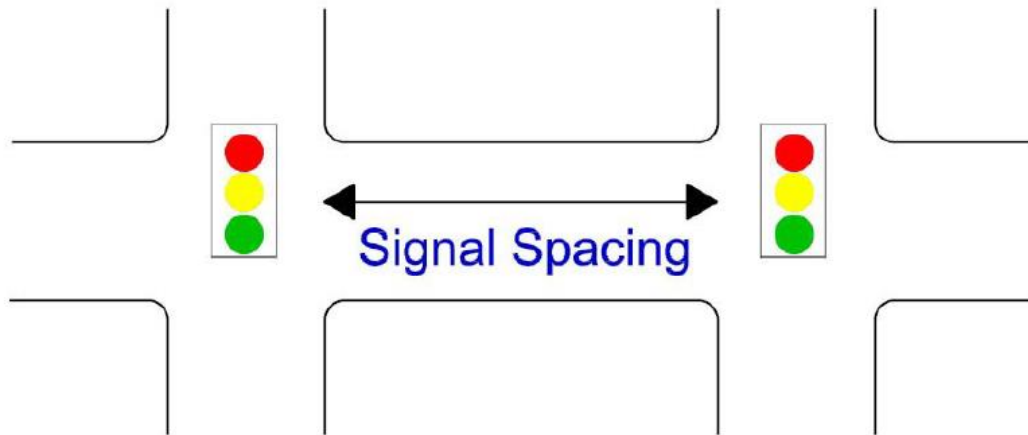
Signalized Access	Throat Length
4 exiting lanes including right-turn lane	≥350 ft, based on traffic engineering study
3 exiting lanes including right-turn lane	250 ft.
2 exiting lanes including right-turn lane	150 ft.

Unsignalized Access	Throat Length
1 entry lane, 2 exit lanes	50 ft.*
1 entry lane, 1 exit lane	30 ft.*

\*In no case should the first access point be located within the radius returns of the driveway.

# Traffic Signal Spacing

Figure 5-17: Traffic Signal Spacing



Functional Class	Traffic Signal Spacing (ft)
Major Arterial	2,640
Minor Arterial	1,320
Collector	1,320
Local	1,320

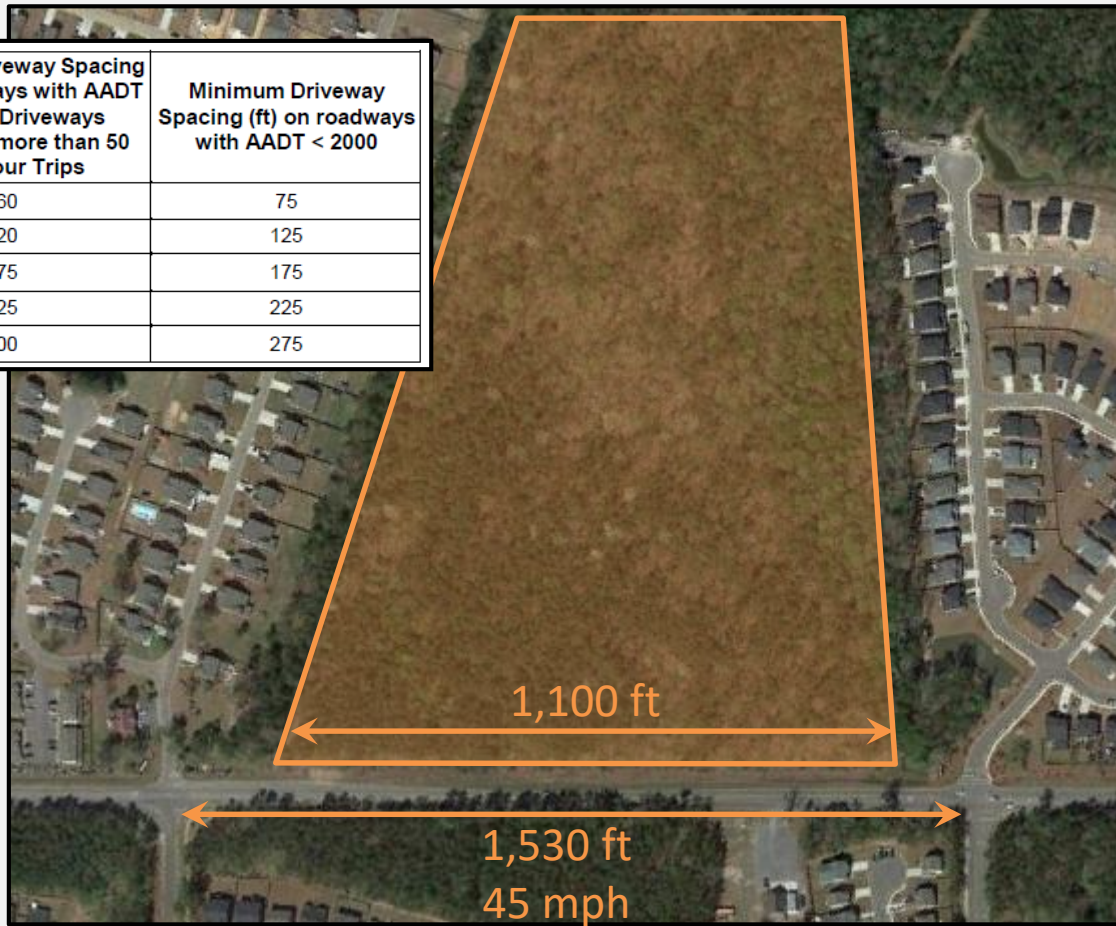
# Driveway Q & A

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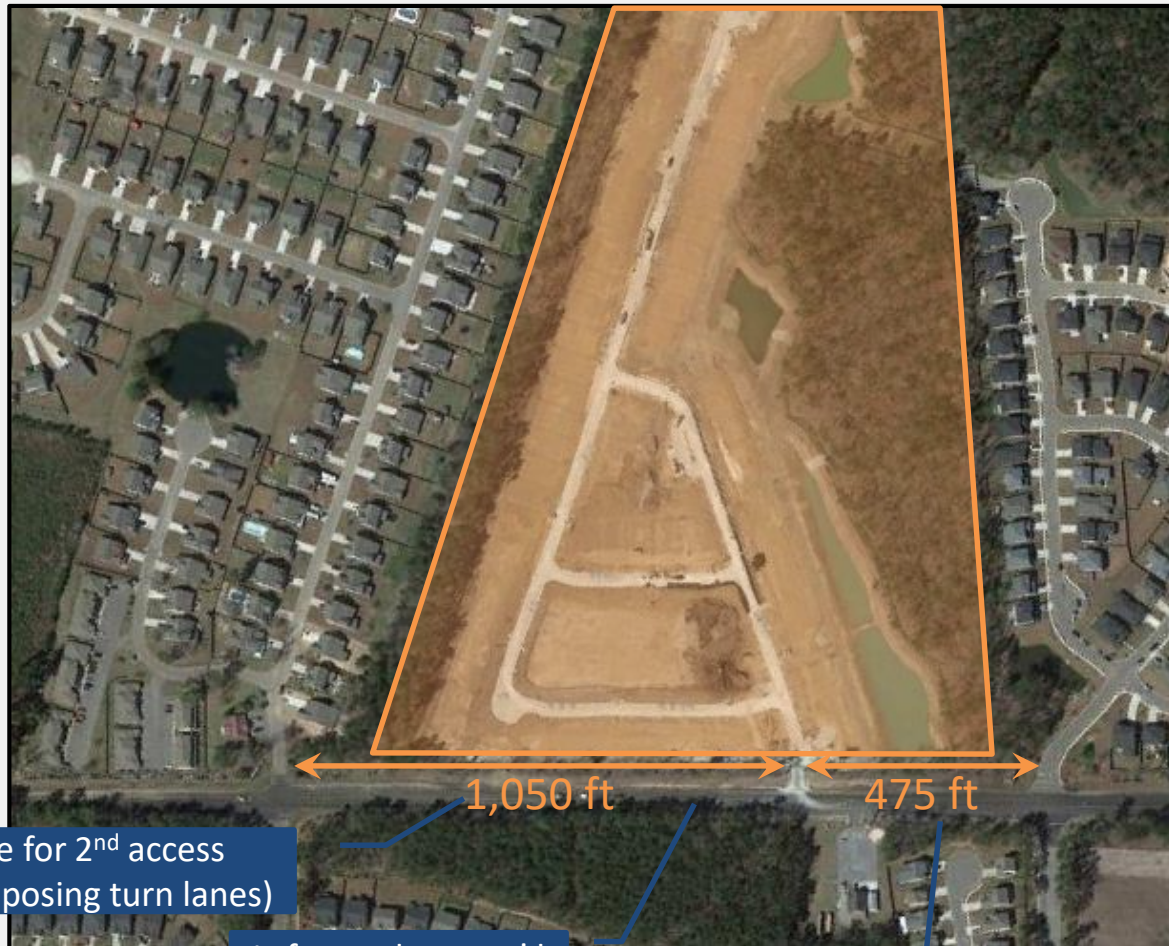
# Driveway Quiz 1

Posted Speed Limit (mph)	Minimum Driveway Spacing (ft) on roadways with AADT $\geq 2000$ or Driveways Generating more than 50 Peak Hour Trips	Minimum Driveway Spacing (ft) on roadways with AADT $< 2000$
30	160	75
35	220	125
40	275	175
45	325	225
$\geq 50$	400	275



Where can driveway(s) be located?

# Driveway Quiz 1



Likely eligible for 2<sup>nd</sup> access  
(depends on opposing turn lanes)

Left-turn lane req'd

Driveway meets spacing



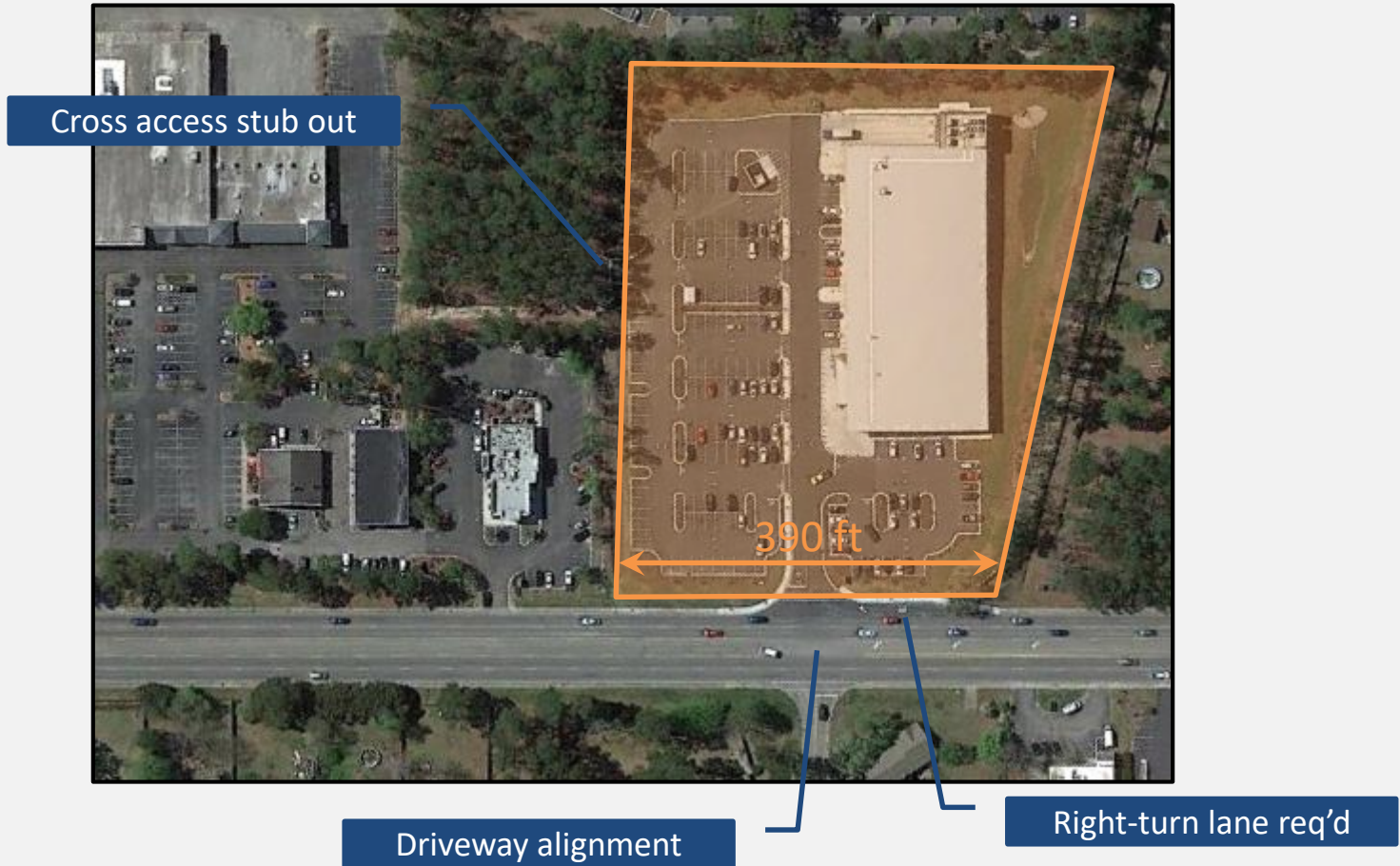
# Driveway Quiz 2

Posted Speed Limit (mph)	Minimum Driveway Spacing (ft) on roadways with AADT $\geq$ 2000 or Driveways Generating more than 50 Peak Hour Trips	Minimum Driveway Spacing (ft) on roadways with AADT < 2000
30	160	75
35	220	125
40	275	175
45	325	225
$\geq$ 50	400	275



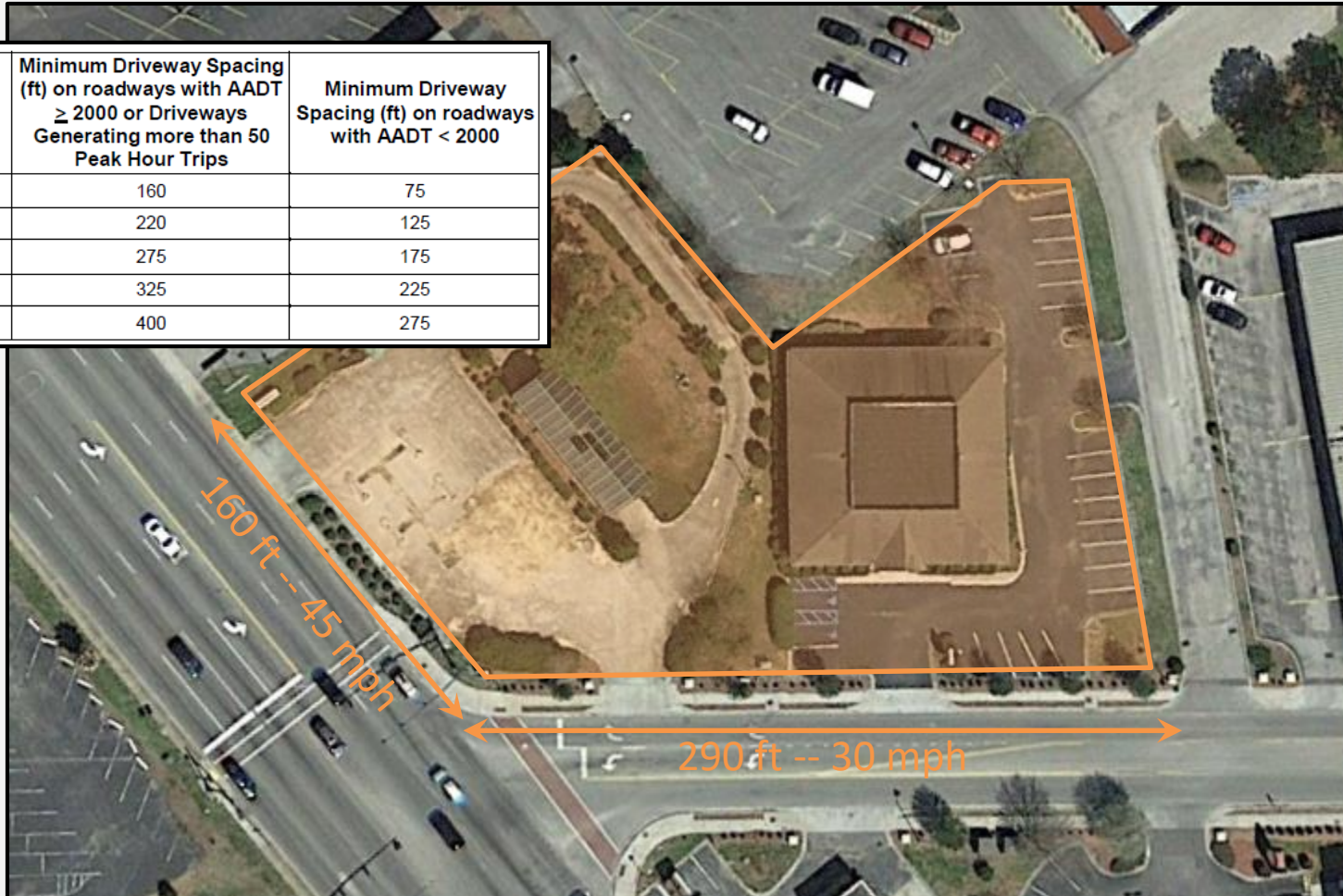
Where can driveway(s) be located?

# Driveway Quiz 2



# Driveway Quiz 3

Posted Speed Limit (mph)	Minimum Driveway Spacing (ft) on roadways with AADT $\geq 2000$ or Driveways Generating more than 50 Peak Hour Trips	Minimum Driveway Spacing (ft) on roadways with AADT $< 2000$
30	160	75
35	220	125
40	275	175
45	325	225
$\geq 50$	400	275



Where can driveway(s) be located?

# Driveway Quiz 3



Internal access previously existed

Not eligible for access

Old driveways should have been removed

Not eligible for full access due to turn lane even if spacing was met (it's not)

# Traffic Impact Studies / Analysis

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- When is a study required?
  - 100 peak hour trips
  - By the DTE
  - By the local government
- Possibility of limited analysis if <100 trips

# Study Steps

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- Trip Generation
- Trip Distribution
- Trip Assignment
- Analysis
- Mitigation / Recommendations

# Trip Generation

- ITE Trip Generation Manual

## Single-Family Detached Housing (210)

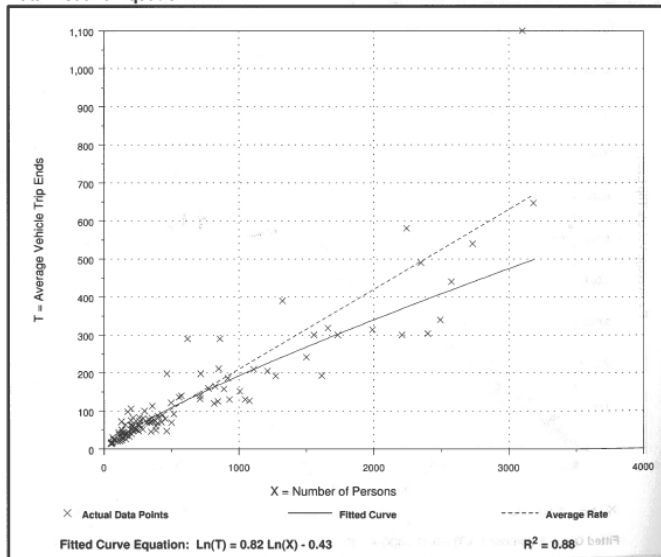
Average Vehicle Trip Ends vs: Persons  
On a: Weekday,  
Peak Hour of Adjacent Street Traffic,  
One Hour Between 7 and 9 a.m.

Number of Studies: 111  
Average Number of Persons: 632  
Directional Distribution: 31% entering, 69% exiting

### Trip Generation per Person

Average Rate	Range of Rates	Standard Deviation
0.21	0.10 - 0.56	0.46

### Data Plot and Equation



## Convenience Market with Gasoline Pumps (853)

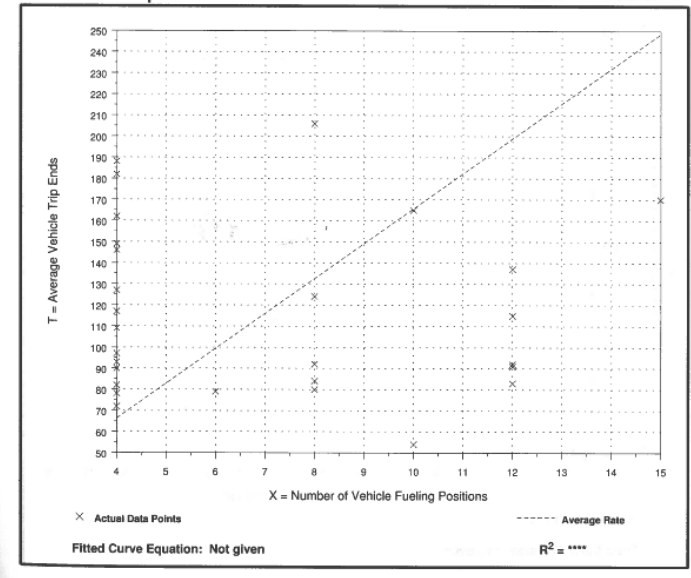
Average Vehicle Trip Ends vs: Vehicle Fueling Positions  
On a: Weekday,  
Peak Hour of Adjacent Street Traffic,  
One Hour Between 7 and 9 a.m.

Number of Studies: 28  
Average Vehicle Fueling Positions: 7  
Directional Distribution: 50% entering, 50% exiting

### Trip Generation per Vehicle Fueling Position

Average Rate	Range of Rates	Standard Deviation
16.57	5.40 - 47.00	11.34

### Data Plot and Equation



# Trip Generation Cheat Sheet

**Table 6-10: Guidelines for Determining the Need for an Impact Study**

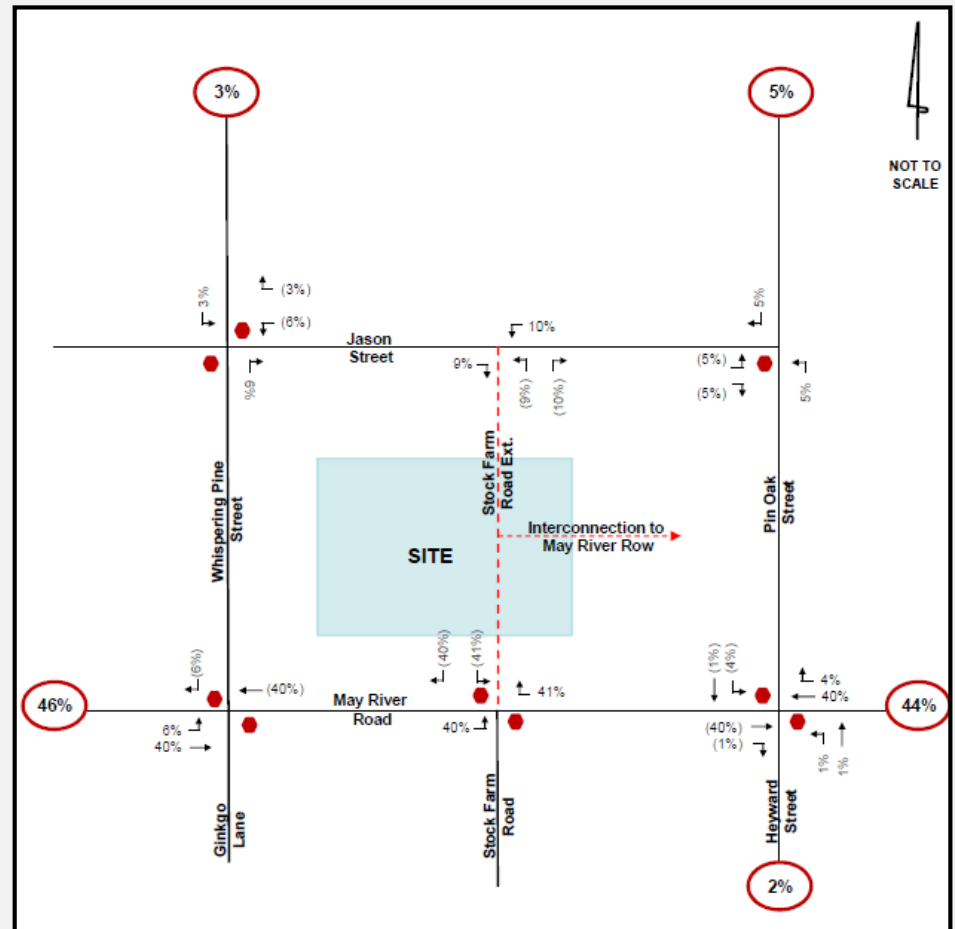
Land Use	100 Peak Hour Trips*
Single Family Home	90 units
Apartments	150 units
Condominiums/Townhouses	190 units
Mobile Home Park	170 units
Shopping Center – Gross Leasable Area (GLA)	6,000 sq. ft.
Fast Food Restaurant With drive-in – Gross Floor Area (GFA)	3,000 sq. ft.
Gas Station with Convenience Store	7 fueling positions
Banks w/drive-in (GFA)	2,000 sq. ft.
General Office	67,000 sq. ft.
Medical/Dental Office	29,000 sq. ft.
Research & Development	71,000 sq. ft.
Light Industrial / Warehousing (GFA)	185,000 sq. ft.
Manufacturing Plant (GFA)	144,000 sq. ft.

\*Rates/Equations used to calculate above thresholds are for the P.M. Peak hour of the adjacent street.



# Trip Distribution

- Factors
  - Existing travel patterns
  - Development type
  - Market area



# Trip Assignment



# Trip Assignment



# Traffic Volumes

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- Generated (project) volumes
- Known developments
- General background growth
- Build vs. No-Build

# Traffic Analysis

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- Capacity
  - Intersection delay / Level of Service
  - Signal phasing
  - Queueing
  - Arterial (mega developments)
- Turn lanes

# Level of Service

Signalized Intersections		Stop-Controlled Intersections	
Control Delay (s/veh)	LOS	Control Delay (s/veh)	LOS
≤ 10	A	0 – 10	A
> 10 – 20	B	> 10 – 15	B
> 20 – 35	C	> 15 – 25	C
> 35 – 55	D	> 25 – 35	D
> 55 – 80	E	> 35 – 50	E
> 80	F	> 50	F

Not uncommon on major roads

# Level of Service Visual

**What is Level of Service (LOS)?**

Level of Service is a quantitative measure of traffic operational conditions. Ranges of operation are defined for each type of roadway section (signalized intersections, freeways, ramp junctions and weaving sections) and are related to the amount of traffic demand at a given time as compared to the capacity of that type of roadway section.

Six levels of service are defined for each type of roadway section and are given letter designations from A to F, with A representing good operating conditions and F representing unsatisfactory operating conditions.













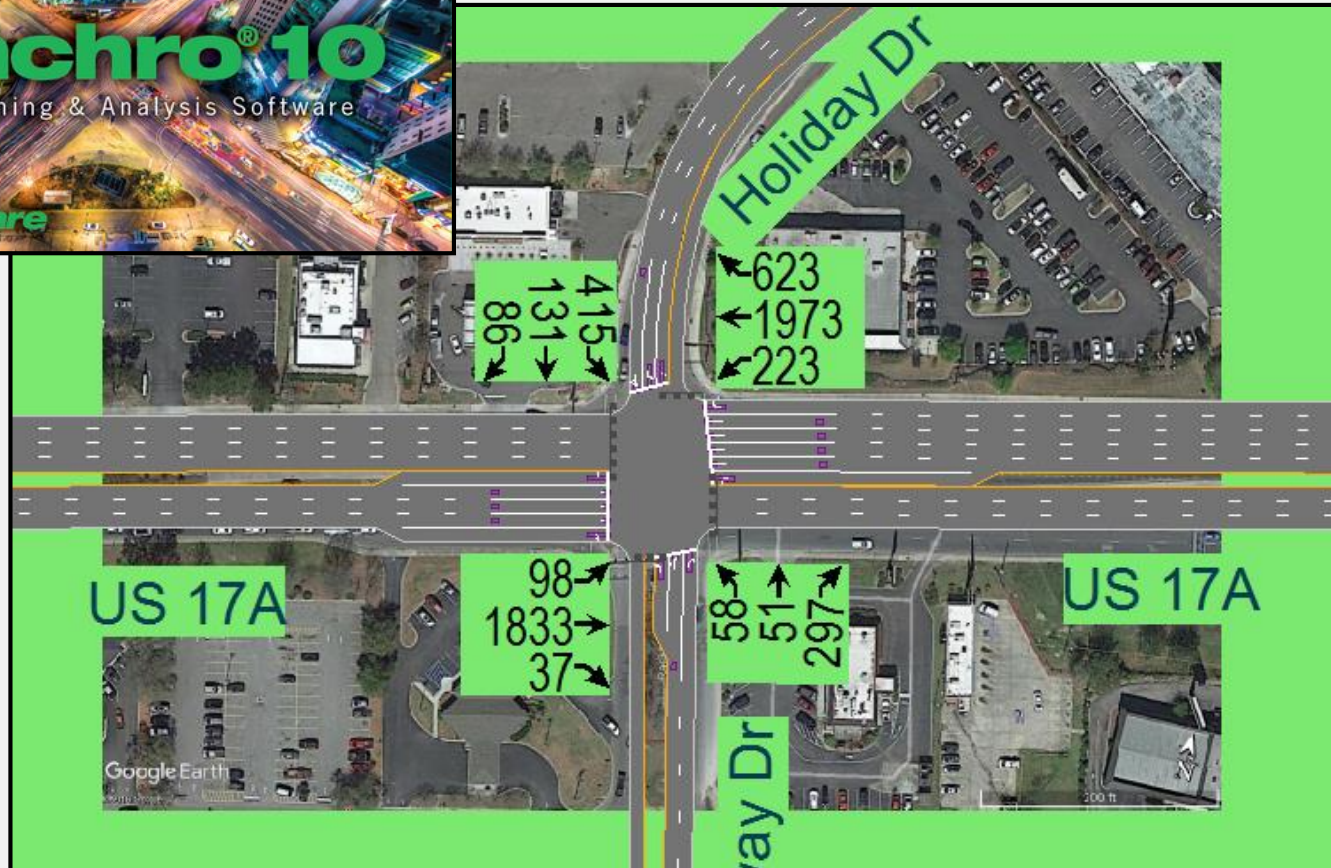
Intersection	Roadway
<ul style="list-style-type: none"> <li>Highly stable, free-flow condition with little or no congestion</li> <li>Delay: &lt;10 seconds/vehicle</li> </ul> 	<p><b>LOS A</b></p>  <ul style="list-style-type: none"> <li>Free flowing</li> <li>Uninterrupted vehicle</li> </ul>
<ul style="list-style-type: none"> <li>Stable, free-flow condition with little congestion</li> <li>Delay: 10 to 20 seconds/vehicle</li> </ul> 	<p><b>LOS B</b></p>  <ul style="list-style-type: none"> <li>Stable flow</li> <li>Other vehicles are more noticeable</li> </ul>
<ul style="list-style-type: none"> <li>Free-flow condition with moderate congestion</li> <li>Delay: 20 to 35 seconds/vehicle</li> </ul> 	<p><b>LOS C</b></p>  <ul style="list-style-type: none"> <li>Stable flow</li> <li>Vehicle operations affected by other vehicles</li> </ul>
<ul style="list-style-type: none"> <li>Approaching unstable condition with increasing congestion</li> <li>Delay: 35 to 55 seconds/vehicle</li> </ul> 	<p><b>LOS D</b></p>  <ul style="list-style-type: none"> <li>High density free flow</li> <li>Operation of vehicle is affected by other vehicles</li> </ul>
<ul style="list-style-type: none"> <li>Unstable, congested condition</li> <li>Delay: 55 to 80 seconds/vehicle</li> </ul> 	<p><b>LOS E</b></p>  <ul style="list-style-type: none"> <li>High density traffic flow, nearing capacity</li> <li>Operating conditions are extremely poor</li> </ul>
<ul style="list-style-type: none"> <li>Stop and go</li> <li>Delay: &gt;80 seconds/vehicle</li> </ul> 	<p><b>LOS F</b></p>  <ul style="list-style-type: none"> <li>Forced or breakdown flow</li> <li>Amount of traffic exceeds capacity</li> </ul>













Image from Maryland.gov

# Level of Service Analysis





# Level of Service Analysis

	 EBL	 EBT	 EBR	 WBL	 WBT	 WBR	 NBL	 NBT	 NBR	 SBL	 SBT	 SBR
HCM Lane Group LOS	E	E	C	F	D	E	E	E	F	F	A	F
HCM Approach Delay (s/veh)	—	62.2	—	—	51.9	—	—	372.5	—	—	102.7	—
HCM Approach LOS	—	E	—	—	D	—	—	F	—	—	F	—

Individual Movement LOS

Intersection Approach LOS

HCM Control Delay(s)	82.9
HCM Intersection LOS	F

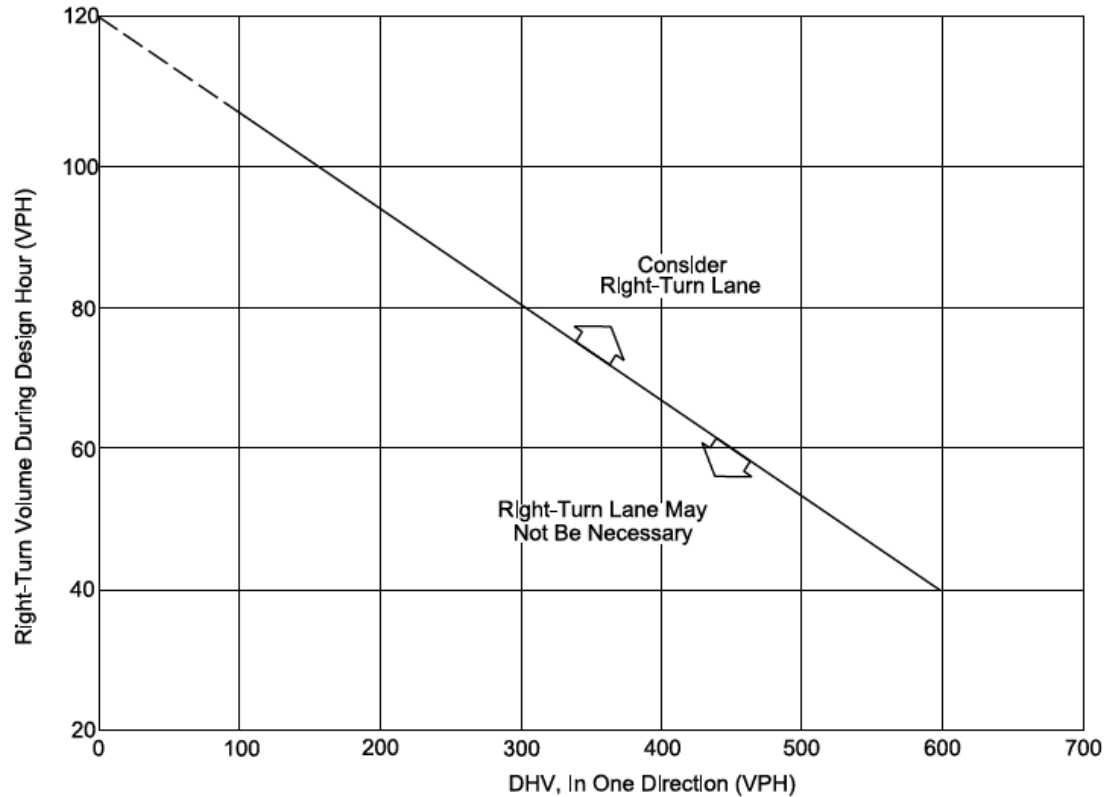
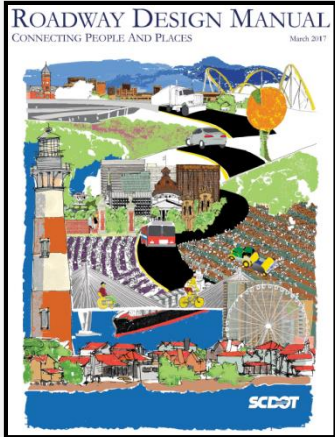
Overall Intersection LOS

# Additional Capacity Analysis

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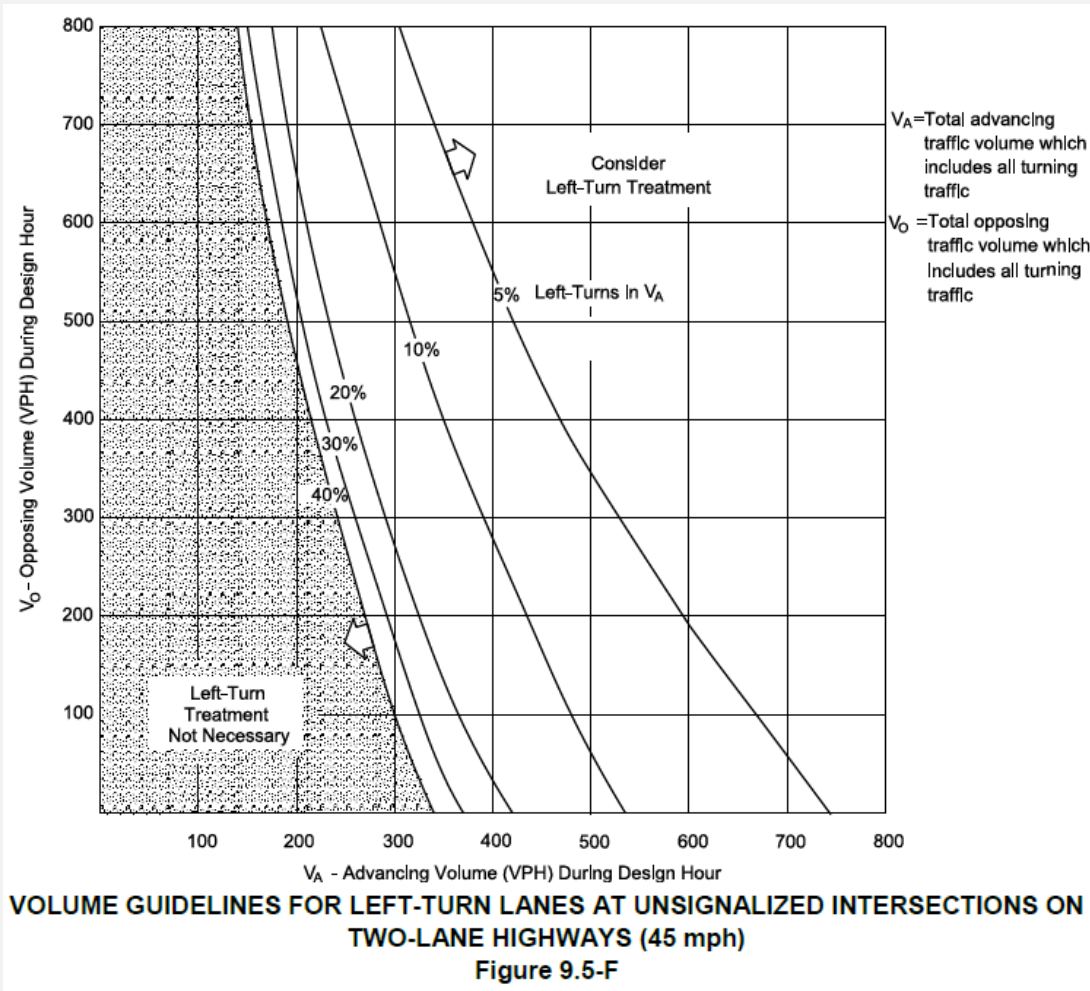
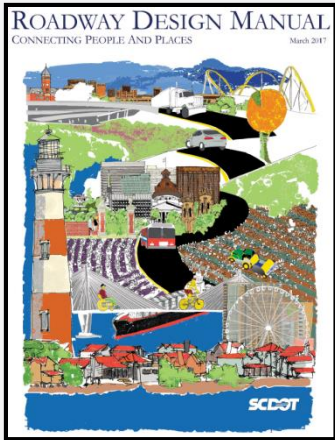
- Signal phasing
  - Determine need for left-turn phase
- Queueing
  - Determine turn lane length at signals & side street stops
- Arterial
  - Determine if road cross section (number of lanes) is sufficient

# Right-Turn Lane Analysis



**GUIDELINES FOR RIGHT-TURN LANES AT UNSIGNALIZED INTERSECTIONS  
ON TWO-LANE HIGHWAYS**  
Figure 9.5-A

# Left-Turn Lane Analysis



# Turn Lane Design

**Table 5-8: Right-Turn Lane Storage Lengths**

Turning Volume (vph)	Percent of Trucks in Turning Volume				
	0% to 10%	20%	40%	60%	100%
50	Minimum length of 100 ft				
100					
150		125 ft	175 ft	175 ft	175 ft
200	150 ft	175 ft	225 ft	225 ft	250 ft
250	200 ft	225 ft	275 ft	275 ft	325 ft
300	250 ft	275 ft	325 ft	350 ft	400 ft
350	300 ft	325 ft	375 ft	425 ft	475 ft
400	350 ft	375 ft	425 ft	500 ft	550 ft

**Table 5-9: Left-Turn Lane Storage Lengths**

Turning Volume (vph)	Percent of Trucks in Turning Volume				
	0% to 10%	20%	40%	60%	100%
50	Minimum length of 150 ft. in Urban Areas Minimum length of 200 ft. in Rural Areas				
100					
150			175 ft	175 ft	175 ft
200		175 ft	225 ft	225 ft	250 ft
250	200 ft	225 ft	275 ft	275 ft	325 ft
300	250 ft	275 ft	325 ft	350 ft	400 ft
350	300 ft	325 ft	375 ft	425 ft	475 ft
400	350 ft	375 ft	425 ft	500 ft	550 ft

**REVERSE CURVE TAPER**

Design Speed (mph)	Radius (ft)	Auxiliary Lane Widths	
		W=11 ft	W=12 ft
$V \leq 30$	300	115	120
31 - 40	480	145	152
41 - 50	670	171	179
$51 \leq V$	840	192	201

**STRAIGHT TAPER**

Design Speed (mph)	Auxiliary Lane Widths	
	W=11 ft	W=12 ft
$V \leq 30$	115	120
31 - 40	145	150
41 - 50	170	180
$51 \leq V$	200	200

# Traffic Analysis Q & A

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# Reality

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- Adjacent property impacts
  - Medians
  - Turn lanes
- Right-of-Way
- Wetlands
- Utilities
- Grand/protected trees
- Historic property

# Navigating Reality

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- Relocate / eliminate driveways
- Reduce development intensity
- Phase the development
- Choose a different site
- Relocate utilities
- Purchase R/W
- SCDOT allow reduction in design (turn lanes)



# Mitigation Philosophy

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- Protect the integrity of the road network
- Compare “Build” to “No-Build”
- Require what is reasonable based on development size
- Fair and consistent

# Agency Coordination

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- SCDOT will:
  - Provide preliminary feedback on driveways
  - Review traffic studies
  - Uphold more restrictive city/county requirements, if possible
- SCDOT requests:
  - Require SCDOT concurrence, specifically regarding redevelopment using existing driveways

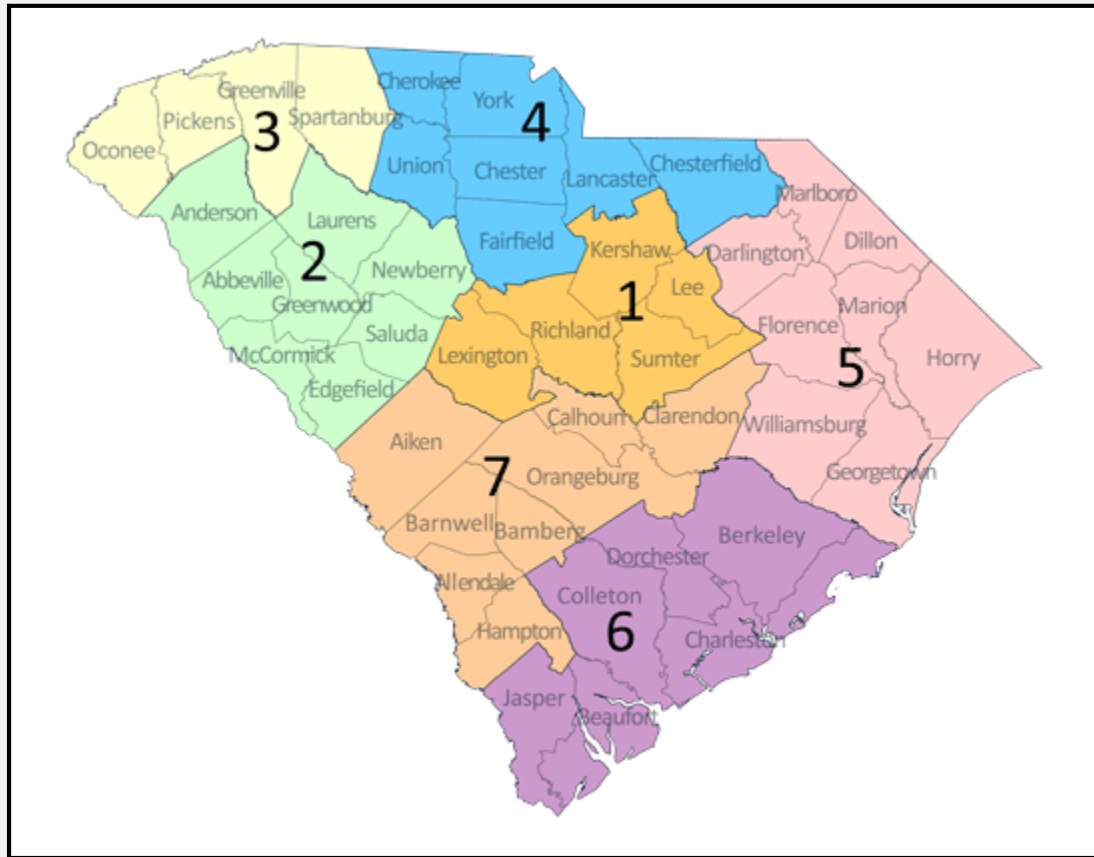
# Additional Q & A

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# Extra Time Discussion

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# District Traffic

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- Signal maintenance
- Signal timings
- Signal design
- Engineering studies
  - New signals
  - Left-turn phases
  - Speed limits
  - All-way stop
  - Sight distance
  - General safety
- Construction plan review
- Encroachment permit review
- Citizen requests (phone)
- Public meetings
- Preconstruction meetings
- Final inspections
- SHEP/Incident Response
- Emergency events